

# **SPECTRALLY TAILORED PULSED THULIUM FIBER LASER SYSTEM FOR BROADBAND LIDAR CO<sub>2</sub> SENSING**

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## **ABSTRACT**

Thulium doped pulsed fiber lasers are capable of meeting the spectral, temporal, efficiency, size and weight demands of defense and civil applications for pulsed lasers in the eye-safe spectral regime due to inherent mechanical stability, compact "all-fiber" master oscillator power amplifier (MOPA) architectures, high beam quality and efficiency. Thulium fiber's longer operating wavelength allows use of larger fiber cores without compromising beam quality, increasing potential single aperture pulse energies. Applications of these lasers include eye-safe laser ranging, frequency conversion to longer or shorter wavelengths for IR countermeasures and sensing applications with otherwise tough to achieve wavelengths and detection of atmospheric species including CO<sub>2</sub> and water vapor. Performance of a portable thulium fiber laser system developed for CO<sub>2</sub> sensing via a broadband lidar technique with an etalon based sensor will be discussed. The fielded laser operates with ~280μJ pulse energy in 90-150ns pulses over a tunable 110nm spectral range and has a uniquely tailored broadband spectral output allowing the sensing of multiple CO<sub>2</sub> lines simultaneously, simplifying future potentially space based CO<sub>2</sub> sensing instruments by reducing the number and complexity of lasers required to carry out high precision sensing missions. Power scaling and future "all fiber" system configurations for a number of ranging, sensing, countermeasures and other yet to be defined applications by use of flexible spectral and temporal performance master oscillators will be discussed. The compact, low mass, robust, efficient and readily power scalable nature of "all-fiber" thulium lasers makes them ideal candidates for use in future space based sensing applications.